AMERICAN MECHANICS' MAGAZINE,

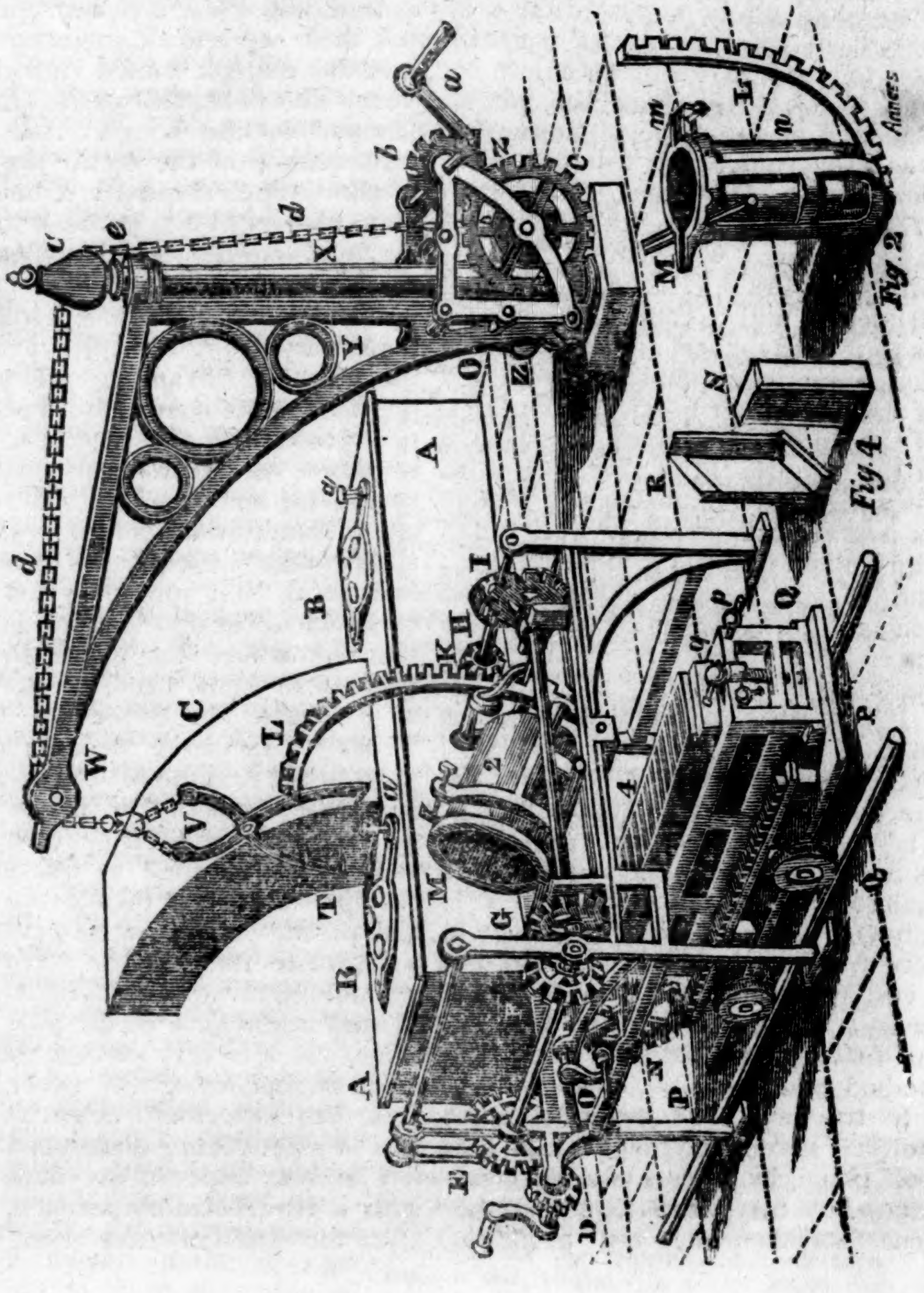
Museum, Register, Journal and Gazette.

"The most valuable gift which the Hand of Science has ever yet offered to the Artisan." *Dr. Birkbeck.*

VOL. I.—No. 6.] SATURDAY, MARCH 12, 1825. [Price $4 PER ANN.

———"The charm dissolves apace;
And as the morning steals upon the night,
Melting the darkness, so their rising senses
Begin to chase the ignorant fumes that mantle
Their clearer reason." *Shakspeare.*

PROCESS OF COINING AT THE ROYAL MINT.



PROCESS OF COINING AT THE ROYAL MINT.

The process of melting Silver, now practised at the Royal Mint, is a recent invention, and a very great improvement. The usual mode was to melt it in black lead pots, and a considerable coinage of tokens for the Bank of Ireland was performed with the meltings done in this way. The importations being entirely Spanish dollars, and the tokens of that standard, the melter could easily melt them in quantities of 60lbs. Troy, which was done. The inconvenience of this mode was severely felt, because ingots of silver of various qualities could not be imported for coinage, from the difficulty of not being able to blend several together in one pot, so as to produce the proper standard of our money. So sensible was Government of this imperfection in the Mint, that, in the year 1777, Mr. Alchorne, then Master's Assay-Master, was sent to visit the Mints of Paris, Rouen, Lille, and Bruxelles, and to collect information as to the arts of coining practised in those mints, and particularly the art of melting silver in large quantities. Mr. Alchorne's intimate knowledge of the English Mint, together with his various and extensive knowledge as a practical chemist, well fitted him for the important undertaking; and his observations on the coin and coinage of France and Flanders are exceedingly creditable to his judgment and knowledge.

It is worthy of remark, that it is on record in the books of the Mint, that, in the recoinage of William III. the pots of silver weighed 400lbs. Troy and upwards; but every trace as to how this quantity of silver was melted is completely lost; and it is only conjectured that it was done in pots made of wrought iron. But not a vestige of a melting furnace, fitted for such a purpose, is to be found in the Tower, nor a single record of the method practised.

In the year 1758, some trials for melting silver in wrought iron pots took place, by means of a blast-furnace; but they were found so laborious, inconvenient, and profitless, as to cause the process to be abandoned.

In 1787, when some silver was imported into the Mint for coinage, new experiments were made by the late Mr. Morrison, then Deputy, Master and Worker, and who conducted the meltings. A blast-furnace was again tried and abandoned. He next attempted to melt the silver in large black lead pots, containing from 100 to 120lbs Troy; but the repeated breaking of the pots although it was attempted to guard them by outside luting, proved a great interruption to the business, and serious loss to the melter. Trial, indeed, was made with cast iron pots, but these were found subject to melt, and the iron got mixed with the silver. The work too was continually stopped by the King's Assayer, in consequence of the metal not being of the proper standard, it being always refined by the process of melting, and lading it with ladles from the pot.

Independently of these considerations, very great difficulty arose at the office in arranging the potting previous to the operation. The practice pursued at the Mint (in order to reduce the metal to standard,) of combining and blending the various ingots of better and inferior qualities, adding what little portion of alloy or fine metal that might be necessary to obtain accuracy, rendered it impossible, where the ingots weighed from 60 to 80lbs. Troy, to pot them of a weight not exceeding 100lbs. Troy. It therefore became necessary, in the first place to reduce the larger description of ingots to a smaller size by melting, and these were again weighed in the office of receipt. Hence a double operation took place, occasioning additional labour, waste, and expense to the melter, and requiring extraordinary trouble and attendance on the part of the office. It was very obvious that this mode of conducting the silver meltings was extremely defective, and was in consequence abandoned.

The next experiments made were with a reverberatory furnace, built after the model of those used in the

Lille Mint. But no better success attended these trials, and the process was, as in former cases abandoned. The imperfection here arose from the great refinement of the silver in the melting, by the oxidation of the alloy, and which the usage of the British Mint does not allow the melter to supply, as in the French Mints. In the French Mints, as soon as the silver is in fusion, a sample is taken out and assayed, and copper is added in the proportion to the refinement of the melted silver (which is kept in fusion while the assay is making;) the whole is well stirred, and immediately laded out and cast into bars.

In the years 1795 and 1798, several farther trials were made by the late Mr. Morrison, who was indefatigable in his endeavours to perfect his department, with a view to attain the object so much desired—that of melting large quantities of silver at once, without producing so much waste and refinement in the metal. In these experiments he tried three furnaces, each of a different construction ; and though he was much nearer his point, there was still an imperfection, arising from the mode of dipping out the metal from the pot with ladles, which chilled the metal, and rendered the process extremely laborious and tedious.

No new experiments were made until the year 1804. Mr. Morrison, having died in 1803, was succeeded by his son in the office of Deputy-Master and Worker of the Mint. The extreme scarcity and defective state of the silver coin at this time, arising from the defective state of the melting department, urged Mr. Morrison to renew the experiments of his father. In following these experiments, Mr. Morrison had in view the construction of a furnace adapted for the use of cast iron pots—the use of pots of a size capable of melting from 400 to 500lbs. Troy, at one charge—the adaption of such machinery as would supersede the clumsy and wasteful process of lading the silver from the pots when melted—and, lastly, the introduction of the use of moulds made of cast iron in place of those then used in the Mint, and which were made of sand.

In all these objects Mr. Morrison, highly to his credit, perfectly succeeded ; and the silver melting department of the New Mint was constructed according to the furnace first used in the experiments which led to such a satisfactory result.—The whole has been in use since 1811,* and the department is capable of melting, with ease, 10,000lbs. Troy of silver daily ; as was done for several months during the late recoinage (1817.)

Having formerly (p. 283, vol. I.) given a description of the apparatus for flatting, rolling, or laminating the silver, we shall now proceed to describe the machinery and furnaces of the silver melting department.

The Engraving prefixed to this article exhibits a perspective view of the Machine for casting Ingots of Silver.

Fig. 1. A A are the furnaces in which the metal is melted. These are the air furnaces, built of fire-brick, in the usual manner of melting-furnaces ; but, to render them more durable, the brick-work is cased in cast iron plates, which are put together with screws. B B are the covers to the furnace ; they are held down to the top plate of the furnaces by a single screw-pin for each ; and on the opposite side of the cover, a handle *a* is fixed. By pushing this handle, the cover is moved sideways upon its centre-pin, so as to remove it from the furnace mouth. A roller is fitted to the cover, to run upon the top plate, and render the motion easy.

The interior figure of each furnace is circular, 30 inches deep, and 21 in diameter ; the bottom is a grate of cast iron bars (each bar being moveable) to admit the air. Upon the grate is placed a pedestal or stand of cast iron, of a concave shape, covered an inch thick with coke or charcoal dust, and upon which the pot is placed in which the silver is melted. The pedestal is nearly two inches thick, and is fully two inches broader in its diameter than the pot, the object of which is to protect the hip of the pot from the very high heat which the current of air, ascending through the grate, when the furnace is at work, creates, and which would otherwise melt the pot. This

---

* Mr. Joseph Cloud, Assayer in the United States' Mint, at Philadelphia, we have been informed, used cast iron crucibles for the fusion of silver, previous to the year 1811. If this be correct, he is justly entitled to credit for the improvement. Perhaps some of our readers can inform us on the subject.—Ed.

precaution is essentially necessary, from the pedestal raising the pot so considerably above the grate, and from its being entirely surrounded by the fire in the furnace. If the furnace, however, is properly managed, there is no risk of melting the pot. On the top or mouth of the pot is placed a muffle, which is a ring of cast iron, six inches deep made to fit neatly into the mouth of the pot; the use of this muffle is similar to that used in melting gold, to give a greater depth of fuel in the furnace than the mere length of the pot, and which gives a greater degree of perfection to the process. The muffle is also extremely convenient, by giving a depth to the pot, if we may so speak, which enables ingots of silver to be charged, which are longer than the depth of the interior of the pot. The top of the ring or muffle is covered with a plate of cast iron, to prevent the fuel from falling into the pot, and secure the metal from the action of the atmospheric air when in fusion. Each furnace has a flue nine inches wide and six inches deep. The flue is four inches from the top of the furnace, and proceeds in a horizontal direction, and extends to the flue C, which is nine inches square, and is carried up in a sloping direction to the stack or chimney, which is 45 feet high from the grate of the furnace.

When the furnace doors, B B, are closed, the current of air which enters at the grate ascends through the body of the furnace, and causes the fuel, which is coke, and which surrounds the melting pot, to burn very intensely. The degree of heat wanted, however, is very nicely regulated by a damper, which is fixed in the flue of each furnace, and exactly fitting the square of the flue, so that any portion of draught can be given to the furnace that may be wanted. The damper is a plate of wrought iron, fixed in a frame, and is easily moved in and out, so as to increase or diminish the size of the flue. It is fixed in the brick-work of the sloping flue C, about 18 inches above the top of the furnace. The furnace doors B have small holes in them to look into the furnace; these are closed by stoppers or plugs of cast iron.

When the furnace is put to work, it is lighted by some ignited charcoal being put upon the grate, and around the pot (for the pot is always in its place before the fire is lighted;) upon the charcoal about three inches deep of coke is put; the door B is shut, and the damper is pulled out about two inches. When the coke is ignited, a similar quantity is put on, and so continued until the furnace is filled with ignited coke. The object of this precaution is to prevent the cracking of the cast iron pot by being too suddenly heated; and it is generally about two hours before the pot can be brought to a charging heat, to do it with perfect safety. Before the silver is charged, the pot is heated a bright red; it is then examined, to see if it has cracked in bringing up, as it is technically called. This is done by placing a cold iron tool of considerable thickness in the centre of the pot, which immediately renders any crack visible to the eye. When satisfied that the pot is sound, the silver is charged into the pot. With the silver is put into the pot, a small quantity of coarsely grained charcoal powder, which coats the inner surface of the pot, and prevents the silver from adhering to it. When the silver is brought to the fusing point, the quantity of charcoal is increased, until it is nearly half an inch deep on the surface of the silver, and which keeps the silver as much as possible from the action of the common air, and prevents that destruction of the alloy which would otherwise cause a considerable refinement in the metal. When the silver is completely and properly melted, it is well stirred with an iron stirrer, so as to make the whole mass of one uniform standard quality. The pot is then taken out of the furnace by the crane, and conveyed to the pouring machine, by which its contents are poured into the ingot moulds.

Fig. 3 is the crane. It is supported by a strong column of cast iron, X, which is firmly fixed in masonry beneath the floor. The gibbet of the crane, marked W Y, is cast in one piece; it has a collar at *e*, which fits upon a pivot formed at the upper end of the column X. At the lower part of the gib is a collar which embraces the column near its base. On these two supports the gib turns freely round, so that its extremity W may be placed over either of the furnaces B B. The wheel-work of the crane is supported in two frames *zz*, which are fixed to the gib by three bolts; it consists of a cog-wheel *c*, upon the end of the barrel, on which the chain winds, and a pinion *b*, which gives motion to the cog-wheel. The axis of the pinion has a winch or hanle (*a*) at each end to turn it round. The chain *d*, from the barrel, is carried up over the pulley at *c*, which is fitted in a part of the gib immediately over the pivot at the top of the column X. The chain then passes over the pully W at the end of the gib, and has the tongs V T suspended to it. These are adapted to take up the pot between the hooks or claws T, at the lower ends. The two limbs are united by a joint like shears, and the upper ends V, are connected with the great chain by a few links. The pot has a projecting rim round the edge, and the tongs take this rim to lift the pot out of the furnace. The pot being wound up to the required height, by turning the handle *a*, the gib of the crane is swung round, to bring the pot over the pouring machine, and it is lowered down into it, for the convenience of swinging the crane round a worm, which is fixed upon the column X at O, and a worm or endless screw is mounted in the frame *z*, to work in the teeth of the wheel. The screw, being turned by a winch on the end of its spindle, will cause the gib to move round on the column.

(To be Continued.)

ON WEIGHTS AND MEASURES.

SIR,—With much pleasure did I learn, during the last Session, that a

Bill for equalizing the Weights and Measures was before the House; and though a variety of circumstances prevented me from giving it due attention at the time, yet I embraced the earliest opportunity of making myself acquainted with the provisions of the enactment. Emanating, as it did, from the venerable Vice-President of the Royal Society, I entertained the most sanguine hopes of our being at last put into possession of a simple and philosophical system of weights and measures, and you will judge of my disappointment upon finding that its provisions were merely to enforce the Acts of 1758, and 1760, and to state the ratio between the "imperial standards" of those Acts and certain "invariable natural standards," which it points out; at the same time that local variations are still to be allowed, as heretofore, on the condition of the ratio of such local weights and measures to these "original and general standard" weights and measures.

However, though the Bill did not meet my expectations, it is certainly well calculated to answer the intentions of its author; still, I think, it would have been better to provide for a total abolition of all local variations from the general standard—if not *immediately* convenient, yet at some future stated period, as, for instance, three years. This proviso would, no doubt, have abolished the practice in much less time; or, taking the lowest view of its efficiency, it would have prepared the public for the change, so as not to throw any difficulties in the way of its operation at the expiration of the intervening term. One advantage, however, arising from the Bill in its present form is, that it gives a something greater power for detecting fraudulent dealers, and is therefore of importance to the consumers of every kind of article in an economical point of view.

Allow me, then, through the medium of your *truly useful* publication, to call the attention of your readers to the principles of a system of weights and measures which unites perfect simplicity with universality of application, and which, so far from being a subject of mere untried speculation, has been in *national operation* for more than the third of a century—I mean the French system of weights and measures. Though the excellence of this system has been duly appreciated by scientific men in this country, I am not aware that it has been presented to the mass of our countrymen in any form whatever. The greatest obstacle that was found to its introduction into France, was found to arise from its not having been made a portion of the general system of elementary instruction; and, perhaps, we shall not be too sanguine in our hopes, when we assert our belief that, in four or five years, the British Public may be brought into a state to adopt this system without any of the inconveniences which were felt by our continental neighbours. Indeed, I conceive that more rests with *you* in forwarding this truly laudable purpose than with any other individual in the British empire; and I feel confident, that, on so important a subject, your assistance and co-operation will not be called for in vain. *You* have the means of explaining, illustrating, and enforcing upon the minds of the operative classes, the *great general utility* and *individual advantage* that must result from its adoption. By your influence it would find its way into those schools where our artisans receive their iota of education, especially when the parents of the pupils see its advantages and call for its adoption; and surely those parents cannot need much inducement to do so, when they find that a boy is obliged to study arithmetic for *about three years* before he enters upon algebra in this country, whereas, in France, *three or four weeks* usually suffice? How much geometry, perspective, drawing, and natural philosophy, might a boy acquire in the time that is thus wasted in our English seminaries, and all through the intricate and absurd systems of weights and measures that prevail amongst us! How much better would the education of our artisans be, if such a facile and philosophical system were adopted! Does not every well wisher to his country feel

interested in the change? And can any man who has the slightest influence remain neutral on so important an occasion?

I propose to hav the new system of weights and measures *added to the usual subjects of a common education*, rather than *substituted for* them; and it is obvious that, under existing circumstances, little more than this can be hoped for, at least till a legislative enactment has abolished the old and intricate system at present in use amongst us.

Let us gradually familiarize our artisans to the change—let your correspondents occasionally use the new system in their communications—let the more intelligent workman explain it to his shopmates, and these to their families—let all calculations given in one measure be converted by your readers into the other, and then back to its original state as so many arithmetical exercises—then will a gradual familiarity with the new, and a distinct perception of the relations of both, be formed throughout society, and loudly call for a legal introduction of that system, the advantages of which will then be so generally felt. Then, indeed, shall we be able to confer upon future generations the most valuable improvement in general education that has ever been attempted—a system that will influence the destinies of our country, by its effects upon the mechanic arts, to an extent that few can at present anticipate!

I shall now, with your permission, give your readers a summary of the principles of the system, and hope to meet with that co-operation from your correspondents that will ultimately render the subject perfectly familiar to the lowest capacity, even though shackled with the complex machinery of English arithmetic.

Principles.

The computed length of the meridian of the earth was divided first into four parts, and each of these into ten million parts. This quantity was taken as the base of the whole system, and was denominated a

Metre.

Now it is obviously unimportant what we take as the base of our system, provided we can always refer to some invariable test by which to determine the accuracy of our unit of measurement. In this view, perhaps, the length of a pendulum, vibrating seconds mean time in a given latitude, and under a given temperature, may be more convenient and more *certain*, though not more permanent than the length of the terrestrial meridian. It will generally, no doubt, be preferred by every country to select for its unit the length of the seconds' pendulum in the latitude of its own capital; but it would be more generally convenient to assume the same unit throughout the world; and that none of these little traits of national jealousy might prevent so desirable an event, it would be well to let the equator be selected for the experiment. To return from this digression, we remark, that all the divisions and multiples proceed by *tens*, or, in fact, that all the operations are reduced to the very simple ones resulting from a decimal scale. The *metre* being unity of length, we have the following table:

Ten millimetre, or ten-thousandth of a metre,	$=\frac{1}{10000}$	$=.0001$
Millimetre, or thousandth of a metre - -	$=\frac{1}{1000}$	$=.001$
Centimetre, or hundredth of a metre - -	$=\frac{1}{100}$	$=.01$
Decimetre, or tenth of a metre - - - - -	$=\frac{1}{10}$	$=.1$
Metre - - - - - - - - - - - - - - - - -		$=1.$
Decametre, or ten metres - - - - - - - -		$=10.$
Hectometre, or hundred metres - - - - - -		$=100.$
Kylometre, or thousand metres - - - - - -		$=1000.$
Myriametre, or ten thousand metres - - - -		$=10000.$

Superficial measure is generally reckoned in square metres, &c. but the unit of *land* measure is the square containing a hundred square

metres, which is called the *are*. The unit of measure for fluids is called the *litre*, and is equal to the cube of the *decimetre*.

The unit of measure for solids is a *centimetre cube*, and is called a *gramme*.

The *metre cube* is used for timber measure.

The multiples and submultiples of all these measures are formed just as in the case of those of length, by the words

Deca, or ten ; as Decametre, ten metres.
Hecto, or a hundred ; as Hectolitre, a hundred litres.
Kylo, or a thousand ; as Kylogramme, a thousand grammes.
Myria or ten thousand ; as Myriare, ten thousand ares.
Deci, a tenth ; as Decigramme, a tenth part of a gramme.
Centi, a hundredth, &c.
Milli, a thousandth, &c.

What is there in all this which any *foreigner* could not learn in a single half hour, even though he had never heard of it before? However, as I have been more prolix than I intended, I shall reserve the remaining remarks I may have to make for a future paper, in which, amongst other matter, I shall give a table of the value of these different *units* in English measure. In the interim,

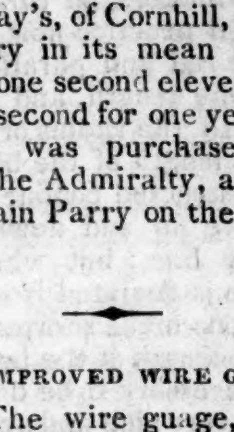
I remain, Sir,
Your most obedient servant,
Bath, Oct. 1824. T. S. D.

CHRONOMETERS.

The indispensable use of the Chronometer in determining longitudes at sea is well known. It has, therefore, become an object with the Government of this country, and of every other maritime state, to render this instrument as perfect as possible.—The variation of a few seconds from mean time might occasion in the navigator a mistake of some miles, and consequently, on a dangerous coast or in a dark night, render the loss of life and property inevitable. The Lords of the Admiralty, alive to the importance of the subject offered last year a premium of 300l. for the best chronometer ; and the eagerness of the competition excited exceeded greatly the value of the reward. No less than thirty-six instruments, made by the most eminent watchmakers in London, were sent to the Royal Observatory at Greenwich. Their respective rates of going were observed with the most rigorous astronomical accuracy, and carefully noted in the books of the Observatory. The approximation of some of them to perfect accuracy will easily be admitted, when we mention that the one which obtained the prize (Mr. Murray's, of Cornhill, No. 816,) did not vary in its mean daily rate more than one second eleven hundred parts of a second for one year. This instrument was purchased by the Lords of the Admiralty, and is now with Captain Parry on the Polar expedition.

THE IMPROVED WIRE GUAGE.

SIR,—The wire guage, offered as a standard will not ascertain the *full* and *exact* diameter at the *tangible points* of the two sides of the guage, which the annexed diagram proves ; for if A and B were the sides of a guage, T T would be the tangible points of the wire, instead of at the true diameter, C.



This may not affect the beneficial use of the instrument, provided it be marked with strict mathematical allowance for the error; so that each mark should stand at the *true diameter* of the wire, instead of at the points where it must touch the guage, or all wire rated by the one offered would be of greater diameter than that instrument would give it.

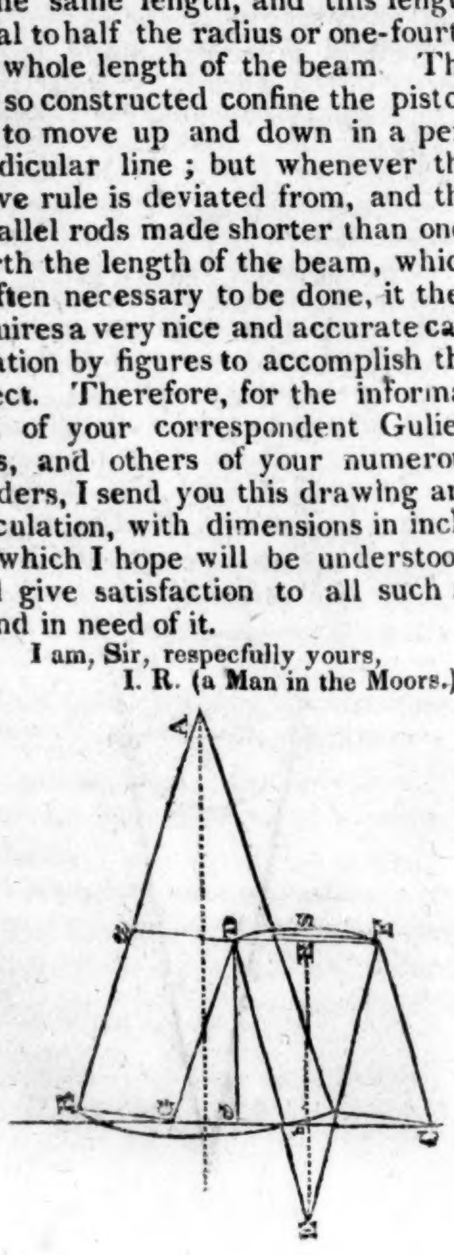
C. HAYTER.

16, Buckingham-street, Portland-road, Sept. 13, 1824.

CALCULATING THE RADIUS ROD OF STEAM ENGINES.

SIR,—I believe the calculation for what is called the Radius Rod of Parallel Motions for Steam Engines, is known but to very few engineers or engine-makers, on this account—the general practice now is to make the radius rod and parallel rod both of the same length, and this length equal to half the radius or one-fourth the whole length of the beam. The rod so constructed confine the piston rod to move up and down in a perpendicular line; but whenever the above rule is deviated from, and the parallel rods made shorter than one-fourth the length of the beam, which is often necessary to be done, it then requires a very nice and accurate calculation by figures to accomplish the object. Therefore, for the information of your correspondent Gulielmus, and others of your numerous readers, I send you this drawing and calculation, with dimensions in inches, which I hope will be understood, and give satisfaction to all such as stand in need of it.

I am, Sir, respecfully yours,
I. R. (a Man in the Moors.)



A B, radius of the beam=49.5 inches, G D, parallel rod=22 inches, and G C, length of stroke=30 inches, given to find E D or E F=radius rod. First, 49.5—22=27.5=A *a*, then as 495 : 30 : :27.5 : 16.666, or D F = chord to segment described by radius rod; then G C, or $\frac{30}{2}$—D F, or $\frac{16.666}{2} = 6.6667 =$ *d* G. We now have got a triangle, D G *d*, with perpendicular and hypothenuse given to find the base, the difference between which and hypothenuse will = H S, or versed sine to the chord D F. Then, by Euclid, book 1st, prob. 47th. $\sqrt{DG^2 - Gd^2} = 20.965$ = D *d*=base, and G D—D *d* = 1,035= H S = versed sine.

Then $\frac{HD^2 \times HS^2}{HS} = \frac{68.125}{2} = 34,0625$ = E F, E D, or radius rod, which, if constructed by the above calculation, will confine the point G to traverse the perpendicular line G C.

N. B. The two lines *a*D and B G represent two links on each side of the beam, to which the parallel rods are suspended, and allow the top of the piston rod, G, to be wholly guided by the radius rod E D, E F.

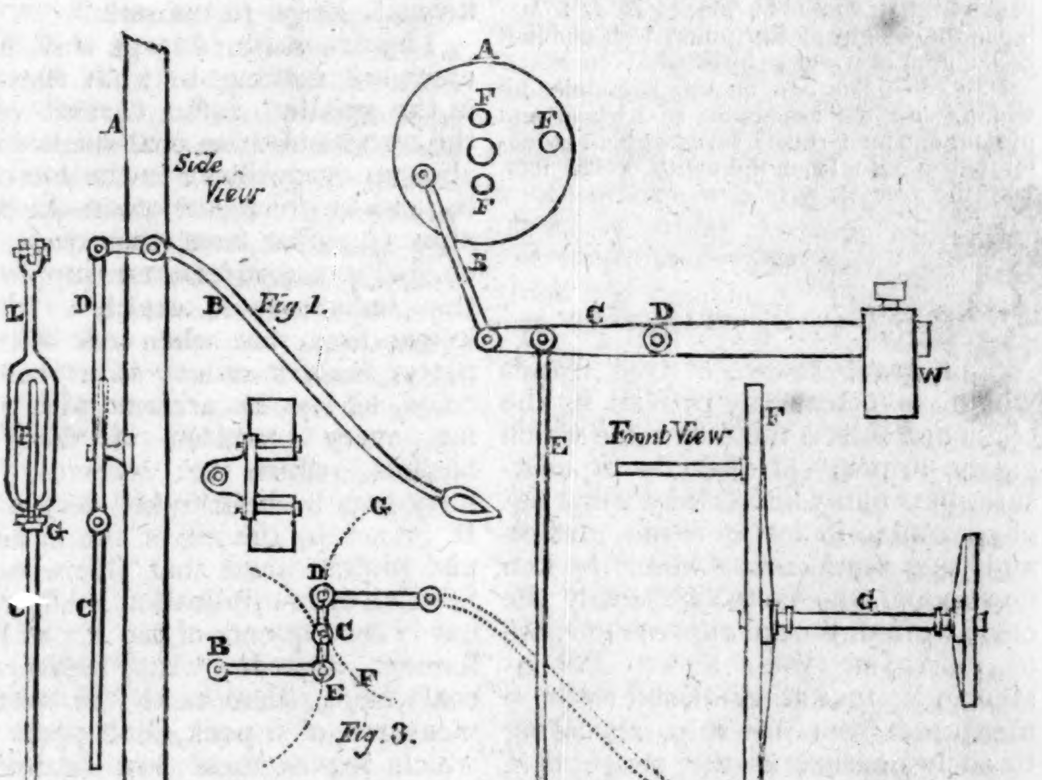
LONDON YEAST.

The Yeast which is employed in London is obtained from the brewers, and hence is often tainted with the hop mixture. In other parts, such, for example, as Edinburgh, the bakers make use of an artificial yeast, prepared in the following manner, which is quite free from any such taint, and answers the purpose of fermentation equally well. To 10lbs. of flour they add two gallons of boiling water; they stir it well into a paste; they let this mixture stand for seven hours, and then add about a quart of yeast. In about six or eight hours this mixture, if kept in a warm place, ferments, and produces as much yeast as will bake an hundred and twenty quartern loaves.

Some years ago, the bakers of London, sensible of the superiority of this artificial yeast, invited a company of manufacturers, from Glas-

gow, to establish a manufactory of it in London, and promised to use no other. About 5000l. was accordingly laid out on buildings and materials, and the manufactory was begun on a considerable scale. The brewers finding their yeast, for which they had drawn a good price, lie heavy on their hands, invited all the journeymen bakers to their cellars, gave them their full of ale, and promised to regale them in that manner every day, provided they would force their masters to take all their yeast from the brewers. The iourneymen accordingly declared in a body, that they would work no more for their masters, unless they gave up taking any more yeast from the new manufactory. The masters were obliged to comply; the new manufactory was stopped; and the inhabitants of London were thus obliged to continue to eat worse bread than their neighbours, becau e it is the interest of the brewers to sell their yeast. B. G.

PUMP IRONS.



Sir,—I send you three plans of Pump Irons, copied from drawings which I have worked by. I have found them to answer very well, when properly made and fixed, and should be highly gratified should you think them worth a place in your Magazine.

I am, Sir, &c.

X. Y. A Millwright.

Blackfriars-road, Aug. 6.

Description.

Fig. 1 is the plan I generally adopt for a common lifting pump. A is the pump standard, with the handle B connected to it; C the pump rod; D a sling, with a double joint at each end: the upper part of the pump rod C passes through a guide above the joint G, which always keeps the pump rod upright; the joints should be bushed with steel and steel pins turned and fitted nicely, and they will last for many years without shaking in the least. But when I am confined for room, as is frequently the case, I use Fig. 3, where A is the joint of the pump lever or handle; B a radius rod of the same length from B to E, as the pump lever from A to D; the ends D and E are connected by a link with three holes in it; the pump rod is slung to the middle hole, and by the radius rod and pump lever being fixed in the same

vertical plane, the hole C will describe a straight line, or very nearly so, provided the arc F G does not much exceed 40 degrees.

Fig. 2 is for deep wells, where the pump is obliged to be fixed in the well. The pump rod E is attached to the beam or lever C, which swings on a centre D; the connecting rod B is also jointed to the beam C at the extremity, the other end being fixed to the crank pin in the flange A, which has holes, marked F F F, at different distances from the centre, in order that the quantity of water to be raised may be regulated by giving the pump rod E a longer or shorter stroke. The flange A is firmly fixed on a shaft, with a fly wheel at the other end, and a handle fixed to turn with the weight marked W, at the outer end of the beam; C has a set screw at the top side, to allow it to be moved farther off or nearer to the centre, as may be required. It should be placed so as to balance the weight of the pump rod, and half the column of water to be lifted.

P. S. I fixed one on this principle, by which, with the assistance of a wheel and pinion, one man raised seven gallons of water per minute, from the depth of 120 feet, with the greatest ease.

HINTS TO COAL PURCHASERS.

The great source of the frauds which so notoriously prevail in the trade in Coals, is the difference which exists, in point of quantity by measure, between coals as they came out of the mine in large round masses, and the same coals when broken down, and, as is too generally the case, wetted, for the express purpose of increasing their bulk. For instance, if a vat of Wallsend coals be measured from the ship, according to such measure as the metre is in use to give, and the coals be then turned out and broken to the size at which merchants commonly send them out to their customers, it will be found, on filling the vat again, that there is a surplus of a full bushel and more. So alive are the dealers to the advantage to be derived from this circumstance, that when a score of Wallsend coals is measured out in the Pool into a barge having four rooms, each containing five chaldrons and a half, as in grain, no sooner does the barge arrive at the wharf, than the coals are taken out broken, and well served with water; nor is the coal-merchant satisfied, unless he can by this practice multiply his five chaldrons and a half into six and a quarter, or even six and a half. Some merchants there are, who, from the keenness of competition, will promise to give sixty-eight sacks to a room: and well they may, for the fact is, that every room of good coals, such as the Wallsend, Percy Main, Cowper, &c, which are all put on board of ship in large blocks, will, when broken down, measure out at least seventy-five sacks! The general rule, however, when a room of coals is bespoke, is to send in only sixty-three sacks with the meter's ticket; the overplus, of twelve or more sacks, the merchant honestly keeps to himself.

The frauds in a large way, however, are nothing to what they are in the smaller traffic carried on by the owners of those coal-sheds which abound everywhere in the metropolis and to which the poor, the least able to suffer from imposition, are obliged to resort for their supplies of this indispensable article. It is a known fact, that when one of these petty dealers orders in a room of coals, he lays his account with turning every chaldron of thirty-six bushels, which he receives, into forty-two bushels to his customers. It is not by the aid of the hammer and pitcher alone that this wonderful trick of multiplication is effected; but in consequence of the Act of Parliament regarding the measure of coals being silent as to the smaller measures of a peck, half peck, &c. which leaves these low dealers at liberty to make, as they do make, a very liberal use of the additional opportunity which this circumstance affords them, of imposing on the poor buyer in the quantity of his hard-earned purchase.

The obvious remedy for all these impositions, whether on a large or small scale, would be to abandon altogether the present erroneous mode of measuring coals, and to have them sold *by weight*, which would put it out of the power of the seller to defraud even in the smallest quantity. It is surprising, indeed, that the necessity for such a change of regulation has not ere now attracted the serious attention of the legislature.

Were the plan of weighing adopted, each sack of coals should weigh, after deducting the weight of the sack, two hundred and fifty-five pounds.

As coals are sold at present, the only rule which can be laid down for the purchaser's protection, applies to the case of buying a whole room of coals at a time. When this is the case, he may stipulate that the room shall be transferred to him as measured out into the barge from the vessel; but this is a condition which he will probably find few sellers disposed to assent to.

It may at first sight occur, that were coals to be sold by weight, the opportunity of committing fraud, by watering them, would be increased. But this is not the case; for if a bushel of Wallsend coals be measured when dry, it will weigh from 84lbs. to 85lbs.; whereas another bushel of the same coals, well wetted, will be found to weigh considerably less. The difference is easily explained on mechanical principles. A bushel of dry coals, let them be ever so round, has always a part small, which runs like dry sand, and fills up every cavity, making the whole nearly a solid mass; but when the coals are wet, they clog together into masses, and leave the cavities unoccupied. R.

BEAUTIFYING AGATES.

Dealers in Gems have a secret method of producing, artificially, some beautiful effects in Agates, which, to the eye, have all the appearance of being natural, and being insisted on as such, serve at times to cheat the amateur out of very high prices. These effects are supposed to be obtained by a succession of blows, adroitly struck, on the stone, previous to its being polished. The means of detecting the artifice, taking it for granted that such is the mode of operation, are sufficiently simple. Every blow must have produced, under the place where it was given, the figure of a regular cone, with its base next to the point of contact. Traces of this figure may sometimes be discerned by the naked eye in the polished stone, and always with the aid of a microscope. To make quite sure of their having been artificially produced, wet the stone, when the traces will be found almost entirely to disappear, on account of the liquid penetrating the fissures, and afterwards to reappear on the stone becoming dry.

HOW TO IDENTIFY SILVER.

Silver, in its native or virgin state, has a great external resemblance to tin, but may, on examination, be easily distinguished from that metal by its being much heavier, and by its remaining unaltered under the operation of fire, whereas tin burns entirely away under a continued heat.

As ores of silver are frequently combined with other metals, it may be of use to furnish the inquirer with a test, by which he may ascertain both its presence and the quantity in which it is combined. For this purpose, let him put a few particles of the ore into a watch-glass; add two or three drops of nitrous acid; then hold the glass over the flame of a candle till the ore is dissolved; after which dilute the solution with water, and stir it about with a bright copper wire. Whatever silver is present will immediately separate from the solution, and attach itself to the wire. Or, instead of making use of the wire, add to the solution one drop of muriatic acid, or common salt, and the silver, if any be present, will be separated in a dense and dull white cloud.

CONTRACTION BY COLD.

Some years ago it was observed, at the *Conservatoire des Arts et Métiers*, at Paris, that the two side walls of a gallery were receding from each other, being pressed outwards by the weight of the roof and floors. Several holes were made in each wall, opposite to one another, and at equal distances, through which strong iron bars were introduced, so as to traverse the chamber. Their ends outside of the wall were furnished

with thick iron discs, firmly screwed on. These were sufficient to retain the walls in their actual position, but to bring them nearer together would have surpassed every effort of human strength. All the alternate bars of the series were now heated at once by lamps, in consequence of which they were elongated. The exterior discs being thus freed from the contact of the walls, they could be advanced farther on the screwed ends of the bars. On the bars projecting on the outside of the walls from the elongation, the discs were screwed up; on removing the lamps, the bars cooled, contracted, and drew in the walls. The other bars became, in consequence, loose, and were then also screwed up. The first series of bars being again heated, the process was repeated; and by several repetitions, the walls were restored to their original position. The gallery still exists with its bars, to attest the ingenuity of its preserver, M. Molard. —*The Chemist.*

EXPANSION OF WATER IN THE ACT OF FREEZING.

SIR,—In the Mechanics' Magazine, No. 60. there is an article on the Contraction and Expansion of Water, copied from *The Chemist.*

It is there stated that water introduced into a tube, and plunged into a freezing mixture, *contracts* till t be reduced to the temperature of 42°, after which it gradually *expands* till it becomes ice. This the writer is pleased to call a *miracle*, and at variance with the general law, that bodies expand by heat and contract by cold. Be it a miracle or not, the fact is but too familiar with us every severe winter, by the bursting of our water pipes. But let us examine what takes place in the conversion of water into ice, and then see whether its floating upon water be sufficient to constitute a miracle.

Water, in the act of freezing, parts with the heat which kept it in a state of fluidity, and in this act there is an internal violence, a different arrangement of parts, or, in other words, a crystallization, in which small particles of air are interspersed, as may be seen by examining a piece of ice. That the admission of air is necessary for the formation of ice, appears by the fact, that water freezes very slowly in closed vessels. By this interspersion of globules of air in ice, it consequently occupies a larger space than it did in the form of water, and is, therefore, so much specifically lighter as to float upon it. Here, then, ends the miracle of *The Chemist*, for it is not the water itself which has expanded or acquired a greater volume, but it is the admixture of air into the mass of congelation

A slight degree of agitation of water in a shallow vessel, just at the point of freezing, much accelerates the congelation, and the crystallization of certain saline solutions is expedited by the same means, showing, by analogy, that ice is a true crystallization.

I am, Sir, &c.

GELIDUS.

A SECRET IN BUYING.

Buy in winter, and sell in summer, whatever is bought and sold by measure. Thirty-two gallons of spirits bought in winter will, without being in the least diluted, make thirty three in summer. The reason is, that all bodies, fluids especially, expand with heat and contract with cold.

NEW STEAM ENGINE.

SIR,—Having, some time since, announced my intention to undertake a set of experiments on Steam, and promised a publication of the results, it may be proper to state, that a variety of unforeseen and unavoidable circumstances, in conjunction with daily avocations of a different sort, have procrastinated the completion of the object much longer than I anticipated. The time, however, I am happy to say, is now not far distant, when I hope to redeem the pledge, and to divest the subject of many absurd notions with which it has hitherto been associated.

It is not my intention now to enter upon the information and facts I have acquired, as they, together with what has been done by others, will, with more propriety, be fully detailed at a future period, more especially as you are acquainted with my opinion of the inefficiency of what has as yet been accomplished, and my ideas of the plan that should have been adopted to effect the object desired. The results, however, of my investigations, though not yet concluded, have given rise to a perfectly novel combination of machinery, as a medium for applying the power of steam, widely differing from any thing that has hitherto been attempted; whereby, as appears from the calculation with which I have furnished you, the effect will be eight times greater from the same quantity of steam, and about fifty times more power will be produced from the same quantity of fuel, than what is obtained from an engine on the plan of Watt. The simplicity of the combination, and the action of the steam, are such, that no very great diminution of effect can possibly take place in practice; but we will assume that the saving will be 19-20ths; even then the advantage will be immense. The space, too, which would be occupied by an engine of forty horse power, will scarcely exceed that of the present cylinder.

Your readers may possibly consider my assertions chimerical, but you, who are more in possession of the subject, will be enabled to form an opinion; and, as soon as arrangements are made, and the improvements properly secured, means will be taken to apply it publicly to some practical purpose, whereby its power will be defined, and placed beyond all doubt. I am, Sir, &c.

W. GILMAN.

Oct. 19th, 1824.

P. S.—Nothing, perhaps, illustrates more clearly the necessity of the object my humble efforts have been endeavouring to accomplish, than the following quotations, which are decisive evidence, as to the little that has been done, by way of experiment, relative to the most economical method of producing steam:—"As to boilers, there is a prodigious difference both in practice and opinion; according to some, eight cubic feet of contents: to others, twenty, are necessary for each horse power. In the Meteor, Sovereign, and Engineer, (which have small boilers,) it requires about one ton of coals in 24 hours for each nine horse power. In other vessels it is double the quantity, or one ton for a four and a half horse power."

[Reference having been made by our Correspondent to the private knowledge we possess of the improvements he has in progress, we have no hesitation in saying, that we entertain but little doubt they will realize the full measure of advantage which he has here promised.—Ed.]

ACHIEVEMENTS OF SCIENCE.

It is well known to philosophers, that there was a time when the laws of the moon's motions were so inexplicable as to defy all human attempts to reduce them to any simple principles, capable of being applied for predicting her future situation for any given time with exactness; and the same could then be said of the tides, the orbits of comets, and various other particular parts of astronomy and natural philosophy: but by the unwearied diligence and researches of a few profound mathematicians, this uncertainty respecting them now no longer exists. There are, indeed, few things of this kind that cannot, by degrees, be brought to some system. Empiric modes are first applied of explaining and computing the several motions; then by investigating, comparing, and gradually approximating to the observations, we come at length to causes which rest on established principles, and ultimately every apparent anomaly is accounted for by a reasonable and satisfactory theory.

EXTINGUISHING FLAME.

Sir,—It may serve to illustrate the observations of Capt. Manby, on the best means of Extinguishing Flame, if you will give a place in your pages to the following results, which I abstracted, some time ago, from one of Sir Humphrey Davy's papers in the Philosophical Transactions:—

"Different elastic fluids have different effects in extinguishing flame; nitrous oxide is the lowest, olefiant gas the highest as to this power; and this does not depend upon capacity for heat or density, but on an actual power of abstracting heat, which is much highest in the combustible gasses, and which seems analagous to *conducting power* in solids and fluids. Steam has very low powers of preventing explosion, and azote has low powers compared to inflammable gasses. The increased cooling power of the azote in condensed mixtures prevents the combustion from increasing very rapidly, and the diminished cooling power in rarefied atmospheres interferes with a rapid diminution of the heat of combustion; so that all pressures which can occur at the surface of the earth, the atmosphere still retains the same relations to combustion."

Bath, O 2, 1824.

SPIRIT OF WINE.

Description of a new Blowpipe: in which the flame is maintained without a lamp, by two opposite jets of vapour.

Bulletin des Sciences Technol.

In the ordinary construction of the Blowpipe, the flame is formed by a jet of alcoholic vapour, kept constantly burning by a lamp, without which the combustion would cease. By forming two jets of vapour, in opposition the one to the other, and uniting them in the middle, Professor Haze found that the inflammation of these jets of alcohol mutually maintained themselves without a lamp.

ANVILS.

Sir,—The expense and difficulty of obtaining good anvils, of foreign manufacture, induced the late Mr. Oliver Evans, several years since, to resort to iron castings, as a substitute for them. He used the white or hardest kind of iron, and cast the face of the anvil upon a smooth plate of the same metal. The experiment succeeded, and these anvils, for common purposes, are in considerably extensive use in some portions of the United States.

I have stated this circumstance, in hopes that its publication in your very useful Magazine may prove beneficial to a highly useful class of our citizens employed in smithery.

FORGE HAMMER.

SUGAR OF STARCH.

The conversion of Starch to Sugar is produced by boiling 100 parts of Starch with 400 parts of water, and from three to eight parts of sulphuric acid in an unglazed earthen vessel, from 24 to 36 hours, constantly stirring the mixture during the first hour or two, and carefully maintaining the original quantity of water, by adding more as it evaporates. When cold, the acid, which continues undiminished in quantity, must be neutralized with chalk, and clarified by charcoal, filtered through flannel, and evaporated to the consistence of oil. The sulphate of lime is to be separated from it when cooled, and the evaporation is then to be continued, till it be reduced to 100 parts of gummy syrup, of the specific gravity 1 295, easily susceptible of vinous fermentation; and when separated from the gum, which in general forms no less than a fifth part of it, capable of being crystallized, and applied to all the common purposes of the sugar from the cane. Such is the account of the process of manufacture given by Mr. Kirchoff, of St. Petersburg, who first discovered it.

C.

DOUBTS *versus* DIFFICULTIES.

Sir,—In the case of "Doubts *v.* Difficulties," it does not appear that the plaintiff has clearly established his point. To use the quaint expressions of *Lawyer Scout*, he ought to have established it "in *law* and in *fact*." I feel pretty certain that your Correspondent "A" has neither wielded a *screw-driver* nor shaken his *twa paws* over a Turkey stone, so long as I have done, otherwise he would have been of a very different opinion. He says the abrasion *must evidently* be produced from a mechanical, and not by a chemical action. I would ask him, *how does he know that?* I never found it difficult to keep the water upon the surface of a Turkey stone; and although water may have been frequently used to the axles of wheels, yet it is only vulgar philosophy that instructs us to believe that it acts as an unguent. As to the *perpendicularity* of the long screw-driver, this is too childish to

need a refutation, as *every mechanic* who is in the habit of using a tool of that description must be aware of the erroneousness of "A.'s" explanation. For the present, however, I pronounce that the extra power arises from the greater elasticity of the long screw-driver, and I would wish that your Correspondent would enter more keenly into the discussion, before you think, good Mr. Editor, of dismissing the subject *simpliciter*. The case to my view, remains in *statu quo*—let him send it to *avizandum*, and pray let us have another *hearing*.

I am, Sir,
Your odedient servant.
NICHOL DIXON.
Red Lion-street, Clerkenwell.

TRUE AND FALSE VIOLETS.

The violet colours imparted to silk are of two kinds, *true* and *false*. The true are produced from cochineal and savory; the false from savory alone. In order to distinguish between them, drop a little of any acid on a piece of the cloth, or expose a piece of the cloth to the fumes of any acid; if the violet becomes changed into red, it is a proof that the dye was of that description called *false*.

OPEN DAYLIGHT.

EXTRACTING FAT BY STEAM.

SIR,—T. J. requests to be informed of a method to extract Fat by Steam, or in any way that it will not come in contact with the fire heat.—I would recommend him to use a double furnace (of copper,) and that the cavity between the two divisions should be kept filled with water, and made steam tight, with a self supplying water-cock, and a safety valve.—With a furnace of this description, any degree of heat may be applied to the smallest quantity of greaves or dregs, and the fat rendered would be found to be of a superior whiteness, which I believe also to be a desirable object.

I am, Sir, &c.
J. P**.
Paternoster-Row.

CURIOUS EXPERIMENT.

We mentioned some months ago an experiment exhibited in Professor Leslie's Class-room, in which a hollow brass sphere was balanced on the top of a jet of water, and made to play up and down, in a manner very striking and beautiful.* We saw the Professor exhibit subsequently an experiment of the same kind with air, but of a more novel and singular description. Two or three atmospheres of common air were condensed into a close copper vessel, of a size which might be conveniently carried in the hand. A stop-cock, with a very minute aperture, fixed on the top of the vessel, being opened, the condensed air rushes out in a stream. If a wooden ball of the size of a school-boy's marble, or larger, is placed by the hand in this current of air, it is not blown aside or suffered to fall, as we would expect, but continues to leap up and down some inches above the orifice, generally performing at the same time a vertical revolution round its axis Though the air and water in the two experiments perform the same office, they act in a very different manner. The water, thrown up by pressure, rises in one unbroken filament, of the thickness of a slender rod, to the height of twenty feet or more; but the air being greatly condensed, the moment it escapes from the tube its particles exert a lateral repulsion, and, instead of pouring upwards in a uniform slender stream, it spreads out into the form of an inverted cone, in the axis of which, where the rarefaction is great, the ball plays up and down. So securely is the ball confined by the conical shell of air which invests it, that the vessel may be inclined at an angel of 30 or 40 degrees, or carried about freely in the hand, without the ball falling off. The ex-experiment has, in fact, something of a magical effect; for, when viewed at the distance of three or four yards, so that the whizzing noise of the air is not heard, the ball seems to leap and play, and attach itself to the vessel by some secret and invisible power of its own.—*Scotsman.*

---

* This philosophical toy may be seen at a pleasure-garden in Chatham-street at any time during the summer.

ANTHRACITE.

Sir,—Mr. William Hood, of this city, has recently made some successful experiments with this species of coal, in fusing iron, in a Cupola Furnace. This particular application, however, is not new—for several Founders in Philadelphia, and the Lehigh Coal Company, have made their castings from iron melted in a similar manner, for some time past. But the great *desideratum* in the use of this fuel is its direct application to the reduction of the ores of iron.—Many attempts to this result have been made; but so far as my knowledge extends, they have uniformly failed. The difficulty, no doubt, arises from the wrong construction of the furnaces; and whoever shall triumph over it, will secure a fortune to himself, and render our country a truly important service.

This coal varies considerably in purity; a specimen analyzed by Dolomieu, contained in 100 parts, only sixty-four carbon, while that from Pennsylvania consists of 90 to 95 parts in the 100, of carbonaceous matter. The coal in the neighbour hood of the Lackawaxen river, is said to be the purest; that on the Schuylkill the lightest, and most easily ignitible; while that from the Lehigh and Susquehanna are the most dense, and difficult to inflame. So long as these coals are sold by weight, the degrees in the facility of combustion will scarcely be noticed; but should they ever be disposed of by measure, they will deserve consideration; because, the more dense the coal are, the greater will be their heat-giving properties.

The difference in purity, also, merits to be taken into account, even though it should amouut to but one *per cent*. Who in these money-saving times, would not prefer ninety-five pounds of coal to ninety-four, when they cost precisely the same money?

The extraordinary purity of the Pennsylvania coal, and the very great degree of heat which may be obtained from its combustion, cannot fail to attract the attention of particular manufacturers, and it is highly probable that it will, at no distant day, form an important article in the list of our exports. Yours, &c.

FULTON.

GOOD SALT.

A difference, in point of quality, greater than is generally imagined, exists between salt recently manufactured, and salt which has undergone depuration, and been well drained from the brine and bittern. Recent salt is not well adapted for preserving meat, or the uses of the table; it imparts to meats a bad taste, vitiates their colour, and prevents them acquiring that firmness which is essential to their preservation. It is, moreover, subject to great waste during its conveyance to any distance, as it dissolves in a moist air, and runs into a liquid state. Salt which is of a good age may be distinguished from recent salt by a taste penetrating, yet free from bitterness; by the solidity of its fabric, and by its not deliquescing when exposed to a moist atmosphere.

PLATINUM.

When Platinum is pure, it is of a silvery white, inclining to iron grey; it resists an intense heat without alteration, but may be easily fused in the focus of a burning lens. It is tarnished with much difficulty, and hence the use which is made of it for the touch-holes of fowling pieces, &c. Its identity may be ascertained by the following test. Dissolve it in oxymuriatic acid, or a solution of chlorine or nitro-muriatic acid (the only substances by which it is soluble,) then add a little muriate of tin to the solution, when the platinum will be precipitated of a reddish colour.

TO RESTORE OLD WRITINGS.

Lay the written papers alternately between sheets of unsized paper; wet the whole thoroughly with a strong infusion of galls or oak bark, and submit them to slight pressure till dry.

ANON.

TO CORRESPONDENTS.

A communication from S. of Baltimore, has been received. Its suggestions are not relative. How is it possible that a work of one thousand copies can be published as cheaply as one of twenty thousand, which is the present difference between those in question? There is reason in all things.

Communications from Fulton—C.—and Anon. have been received, and shall meet early attention.